COMMONWEALTH OF VIRGINIA

Information Technology Resource Management Guideline

PLATFORM ARCHITECTURE

Virginia Information Technologies Agency (VITA)

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Preface

Publication Designation

ITRM Guideline PLA 140-01: Platform Architecture

Subject

Platform architecture best practices

Effective Date

The Information Technology Investment Board (ITIB) approved the platform best practices as specified herein when it approved the Platform Architecture Report on 3-3-2004. To accurately reflect the version of the best practices presented in this document, the effective date for this document has been set as the original date of approval of best practices by the ITIB. When these best practices undergo a comprehensive review and revision, the guideline's effective date will reflect the date the revisions were approval by the ITIB.

Supersedes

None

Scheduled Review:

Annually

Authority

Code of Virginia, §2.2-2007 (Powers of the CIO)

Code of Virginia, § 2.2-2010 (Additional powers of VITA)

Code of Virginia, §2.2-2458 (Powers and duties of the board [ITIB])

Scope

The guidance provided is appropriate for all state executive branch agencies including institutions of higher education (referred to as "agencies" in this document) unless otherwise indicated.

Purpose

To provide additional guidance beyond the requirements noted in the ITRM platform architecture policy and standard, which govern the acquisition, use and management of personal computing, server and storage technologies by state executive branch agencies.

General Responsibilities

The Chief Information Officer of the Commonwealth (CIO)

Directs the formulation and promulgation of ITRM guidelines

The Virginia Information Technologies Agency (VITA)

Drafts the ITRM guidelines

Updates the ITRM guidelines

Considers requirements in the ITRM guidelines when establishing contracts, reviewing procurement requests, developing services and managing services

The Information Technology Investment Board (ITIB, the Board)

Approves the guideline requirements or delegates approval to the CIO

Executive Branch Agencies

Provide input during the drafting of the guidelines

Provide input for the review and updating of guidelines

Consider guideline information in planning for the acquisition and modification of platforms

Related ITRM Policies, Standards, and Guidelines

ITRM Policy PLA 139-01, Platform Policy

ITRM Guideline PLA 140-01, Platform Standard

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Overview

This document provides the Information Technology Resource Management (ITRM) guidelines for computing platforms, which are used by Commonwealth executive branch agencies. The platforms addressed by this guideline include servers, personal computing[1] devices and storage systems. This guideline contains recommended practices and procedures that may affect the platform decisions made by executive branch agencies There are two related documents: the *ITRM Platform Policy* address the rationale for establishing platform architecture requirements and the *ITRM Platform Standard* addresses requirements related to platform acquisition, platform leasing, seat management contracting, application service contracting, operating system selection, basic software acquisition (e.g., for desktops and laptops), server to storage connectivity, storage design decisions, and platform refreshing.

This guideline is one part of the Commonwealth's Enterprise Technical Architecture. Its development also supports mandates of the 2003 General Assembly that centralized responsibilities for platforms and platform services for executive branch agencies. These two efforts support the effective and efficient use of platform resources to address Commonwealth business requirements.

The Enterprise Technical Architecture is divided into eight domains or areas of technology. The platform domain is one of the eight technical domains. The eight domains are as follows:

1. Network
2. Platform
3. Database
4. Middleware
5. Application
6. Information
7. Systems Management
8. Security

This guideline includes optional best practices for three components of the platform architecture: personal computing, servers, and storage. Questions related to platform architecture may be addressed to Policy, Practices and Architecture staff members in Strategic Management Services Directorate of the Virginia Information Technologies Agency[2] (VITA).

[1] In the electronic version of this document, the Glossary entries are hyper-linked to the first occurrence of the entry in the document text. In the printed version, a hyper-linked Glossary entry appears as an underlined word in the text.
[2] The VITA Strategic Management Services Directorate reception phone number is: 804-225-3622.

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Guidelines

The optional recommendations for the platforms are presented in this standard in the following four categories:

- Personal Computing
- Servers
- Storage Solutions
- Platforms Generally

Personal Computing

Personal computing devices include desktops, mobile computers (notebooks and others) and personal digital assistants (PDAs). Personal computer guidance spans software, hardware and selected peripherals. Personal computing software includes the operating system and productivity software. Most government workers are knowledge workers. The productivity software typically used by knowledge workers is word processing, spreadsheet, presentation, Internet browser, Adobe Acrobat Reader and mail client software. A small percentage of knowledge workers also use desktop databases.

Personal computing guidance is directed mainly to decision makers in VITA who conduct evaluations of personal computing alternatives, establish contracts for personal computing purchases, or provide personal computing installations and support. The following recommended practices are best viewed in combination with the mandatory requirements that are in the *ITRM Platform Standard*. Together, they provide a comprehensive approach to achieving a cost-effective, unified program for addressing personal computing needs.

Chipset Bid Specifications: *When establishing minimum specifications for bids for low-end personal computers, VITA should use the lowest of currently available Intel, Athlon, or comparable chipsets that will meet anticipated processing needs for the proposed productivity software for the proposed refresh cycle.*

Mobile Chipsets: *VITA should select specialized chipsets for notebooks to better meet the needs of the mobile worker.*

Wireless Connections for Mobile Computers: *VITA should equip the standard mobile notebook computer with a wireless (e.g., IEEE 802.11 standard) interface card to enable state workers to take advantage of wireless connectivity provided in public spaces. Alternatives may be required if many agencies are concerned about allowing employee discretion in using wireless services.*

Personal Computing Software Alternatives: *The Enterprise Architecture team recommends that Virginia conduct its own controlled study of the costs and benefits of desktop provision alternatives and other personal computing*

alternatives as soon as possible. Options for support, hardware, and software (e.g., OS, productivity software, antivirus software and management software) would be addressed. The proposed study for desktops would provide information on alternatives to the presently used Microsoft desktop solutions, which could be used to establish reasonable cost targets for future Microsoft product negotiations. If unsuccessful in Microsoft price negotiations, Virginia would then have a viable alternative strategy to implement that would cost less and meet business needs. When comparing personal computing alternatives, Virginia should:

- *Establish lifecycles for desktop and notebook hardware that are appropriate for the specific solution. For example, Microsoft products may require a 3-year [hardware] refresh due to escalating resource usage by Office suite upgrades and an open systems solution might have a lifecycle of 5 years.*
- *Compare the following solutions at a minimum: 1.) A Microsoft OS with Microsoft Office Professional 2003; 2.) A Microsoft OS with an alternative office suite (perhaps StarOffice, Corel, and OpenOffice); and 3.) An open systems solution such as Linux with OpenOffice or Sun's Java Desktop.*
- *[Categorize Commonwealth jobs from low to high need for office software capabilities.] Compare workforce training/retraining cost using training to the functional requirements of typical jobs [within the small number of categories.]*
- *Separately calculate one-time changeover costs including application modifications.*
- *Compare support staffing and support staff training requirements (including development staff training).*
- *Use an appropriate mix of current hardware and software as the baseline from which change costs are to be calculated.*
- *Obtain and use appropriate information on support/programming skills of the current Commonwealth technical workforce.*

***Floppy Disk Storage**: VITA should notify agency heads that floppy disk drives are no longer standard equipment on new computers. Agencies should implement plans that mitigate the effects of this change.*

***Do Not Upgrade PC Software:** Enterprise Architecture recommends that agencies and central services do not upgrade operating systems software or office productivity software during the life of the desktop.*

One concern about using this approach is that support staff may have to support many versions. The organizing of personal computer support teams by OS/software version combinations rather than by agency may mitigate this

problem. This would also facilitate the tracking of problems by version of software and year of hardware.

Servers

Servers range from single processor computers to scalable multiprocessor servers and mainframes. Server guidance may be of interest to agency personal or to VITA personnel who are involved in server consolidation and central management of servers.

Agencies typically procure servers from state contracts to address very specific business and operational needs or procure services on a centrally managed consolidation platform (a server which supports multiple applications and/or application tiers). Agencies also procure hosting services. Another frequently used avenue for meeting business needs is agency procurement of application development solutions, turnkey solutions, or application hosting solutions via requests for proposals (RFP).

VITA has been tasked by the General Assembly to provide for the centralized management of agency servers and provision of consolidation platforms. VITA is interested mainly in the joint management capabilities for server solutions, support contracts for servers, I/O capabilities, network connection capabilities, remote management capabilities, energy usage, heat considerations, and footprint/density issues.

VITA procurement experts typically establish the procurement contract options. For servers, a typical contract would list server offerings for a vendor and percentage discounts.

Agencies have existing server architectures (i.e., platforms and operating systems designed to meet their specific business needs) that were in place prior to efforts to centralize support and consolidate. Decisions regarding operating systems updates, software updates, hardware replacements, and new platform acquisitions are part of the agency's information technology strategic plan. The agency must plan for eventual movement from their existing server architecture to the Commonwealth's desired architecture. The desired architecture is specified by requirements in the *ITRM Platform Standard*. Whether this is done when hardware becomes outdated or when applications are replaced or significantly modified is a decision that must be made by the agency based on cost and benefit analyses done application by application.

Serial Ring NUMA High-end Servers: *Virginia should determine if cost savings can be realized by identifying and replacing any serial ring NUMA platforms.*

Use NUMA Architectures: *For its high-end symmetric multiprocessing needs, Virginia should use only servers that employ NUMA and similar proprietary high-end interconnection solutions until Remote Direct Memory Access (RDMA) and other future technologies become enablers of competitive scale-out solutions.*

Reduce Consolidation Options and the Management Systems for Them: *Virginia should control the number of different management systems, third-*

party management solutions, and OS management vehicles used in providing both scale-up and scale-out consolidation solutions.

16 Bit Applications on 32 bit Chips: *Virginia should be very cautious in using Intel Itanium processors in any scale-out solutions without addressing 16 bit application use, 32 bit application performance problems, and processor heat problems in dense configurations.*

Windows Datacenter: *Virginia may consider Windows Datacenter for scale-up solutions in the future (e.g., perhaps by 2005). Some considerations are whether the Windows 2003 improved workload management is proven to be effective and whether cost-effective, comparable implementations are identified. For existing 32-bit applications on Windows, scale-out solutions are expected to be more effective for consolidation.*

Competition Among High-end Providers in the Desired Architecture: *Virginia agencies should consider all high-end platforms in the architecture as potential candidates for any application that requires high-end server performance, availability, scalability, and security.*

Low Risk Uses of Linux: *At present, the most appropriate opportunities for using Linux in Virginia Government are for Website related applications (e.g., proxy servers, Internet firewalls and cache for improved Web page access).*

Consolidation Options: *Both scale-up and scale-out solutions are strategic options for consolidation in Virginia. Scale up solutions may begin on midrange platforms that can scale to high-end size.*

Developing Platform Patterns by Workload Type: *Virginia should define platform strategies by workload type.*

Leveraging Enterprise-wide Business Opportunities: *Virginia should leverage its business volume, its central control, and the cost-benefits of simplification in all platform procurement and scaling decisions.*

Research Appropriate Successes with Windows Datacenter: *Virginia should be cautious in future considerations of Intel scale-up solutions using Windows Datacenter without strong proofs of concept and/or actual implementations of similar magnitude and purpose that demonstrate cost-effective, manageable, high-quality solutions.*

Server Appliance Use: *Virginia should consider server appliances for cache, Web serving, storage, and other simple uses.*

VMS Transitioning: *Virginia's agencies that presently use OpenVMS and VAX VMS should begin to address transition options in their long-range plans.*

Staff and Staff Skills Data Needed for Planning: *[As part of planning for the transition from the current architecture to the desired future architecture,] Virginia should track data on staffing, staff retirement plans, staff skills and staff retraining interests.*

Hardware and Software Retirement Plans Data: *Virginia should track data on hardware and software retirement plans.*

Consolidation Opportunities Ordering: *Virginia should first define its consolidation options for non-file-service storage (i.e., block services storage) and then define consolidation platform management services, email consolidation, file/print services consolidation, and web hosting services consolidation.*

Acquisition and Maintenance as Cost Comparison Ingredients: *When conducting cost-benefit analyses for an application, individual agencies or central services should consider full costs of server alternatives and not just up-front costs.*

Server Decisions Demand Application and Enterprise Views: *Individual agencies and VITA should consider the agency's goals, the Commonwealth's goals, and Enterprise Architecture guidance when selecting server solutions.*

Balancing Common Central Management Practices with Server Difference: *Individual agencies and VITA should employ manufacturer-specific systems setup policies and best practices.*

Server Support Levels Based on Business Requirements: *Individual agencies and VITA should ensure that the maintenance support response-time is in line with business needs for applications on each specific server.*

Potential Cost Savings from Homogeneous Skill Sets: *When an agency employs a different server solution in an otherwise homogeneous shop, the agency should consider supporting the different server by using in-sourcing (i.e., contracting with another agency or with VITA) or outsourcing alternatives.(This addresses decisions prior to agency integration.)*

In-house or Outsourced Use of Linux for Web Serving: *The Commonwealth should evaluate Linux for Web serving. Linux is opportune because of anticipated cost savings and because it is being explored worldwide as an alternative to Windows for selected lower-risk uses. Linux may be used on individual midrange to low-end servers or may be managed as a virtual server on a high-end system.*

Centrally Controlled Forest Structure: *If the Commonwealth requires use of Windows 2000 (or higher) as the operating system of choice for all domain control functions, the Commonwealth should implement a centrally controlled forest structure across all executive branch agencies. A forest (also known as an enterprise) is a collection of domains and domain trees.*

Storage

The term storage is used here to mean the hardware, software, communications, and management systems required to record data somewhere other than in memory (e.g., RAM) and to index the data in a manner that allows it to be retrieved at a later time. Typical storage solutions include file servers, server direct attached storage (DAS),

network attached storage (NAS), and storage area networks (SANs). A detailed explanation of storage and storage solutions is provided in the *Platform Architecture Report.*

Agencies, designers of central utility services, procurement officials and others make storage system decisions. Agencies have an existing architecture to meet their storage requirements. The storage solutions agencies employ are typically application specific and dedicated to a server or a cluster of servers that serve one application. Agencies are responsible for the creation and maintenance of business applications including the selections of storage solutions and planning for ongoing storage needs.

Those who centrally manage servers and their storage also have the opportunity to consider storage alternatives. The availability of central solutions that can be shared across servers will assist both server managers and agencies.

VITA procurement experts may use storage guidance in their selection of service and solutions to place on state contract. These experts would also place the component parts of end-to-end solutions on state contract.

Design and Provision of Storage Solutions: *VITA and any other agencies, including administrative units of higher education agencies that provide platform services should consider all platforms under their control when conducting capacity planning and when developing a storage plan. For consolidated servers or data-center resident applications, the managing agency should examine storage needs at the application level but design storage solutions at the data center level.*

Considering All Storage Options: *Individual agencies that control storage, including administrative units of higher education and central storage planners (e.g., VITA), should consider a variety of storage alternatives. NAS, SAN, DAS, file servers, NAS/SAN combinations, and in/outsourced services may all be appropriate depending on storage volumes, LAN bandwidths, connectivity to central services, and other factors.*

Platforms Generally

Some best practices apply across platforms. Guidance statements that address more than one platform type are provided below.

Front-Facing USB Ports: *VITA should require that desktop and server units on state contract have multiple front facing USB ports. This is an enabler for using USB key fobs for authentication, USB keys for storage, PDAs, and other USB peripherals.*

Contract Renegotiation for Platforms: *VITA should include opportunities for annual renegotiations in all high-volume outsourcing contracts to ensure that outsourcing remains cost-effective as market and other conditions change.*

Glossary

High-end Server – defined as servers with a greater than 16 processor scale-up limit and typically costing more than $250,000.

Midrange to Small Server - in this report, servers costing $50, 000 or less are typical midrange to small servers. These servers would usually have one to four processors, but could have as many as 8 or 16 processors. When the midrange computer is a scaled-down version of a high-end server, it may cost substantially more.

Personal Computing – devices and device components for desktop computers, notebooks and handheld computers including operating systems, hardware components, productivity software, and security software.

Platform Architecture - defines the personal and business computing hardware systems to be used by agencies. The platforms may include servers (e.g., high-end servers and midrange to small servers), storage systems, personal computing devices (desktops, notebooks, and hand-held computing devices), and other hardware (e.g., printers). In addition to platform hardware, the Platform Architecture addresses operating systems, configurations, network and device-to-device interfaces, and selected peripherals (e.g., floppy drives). In the instance of personal computing devices, the architecture also addresses base productivity software, security software, and utilities that are necessary to make the hardware useful to users. The architecture addresses decision criteria and best practices for the acquisition and deployment of platforms. The architecture also identifies management and remote access components, which are critical to platform use. Details regarding management components are addressed in the Systems Management Domain.

Productivity Software - software typically used by business professionals such as word processing, spreadsheets, presentation slides, web browsers, and plug ins. Also includes lesser used software such as personal database software, flowcharting, project management.

Scale-Up Solutions -1) from an application perspective, a scale-up solution is one that permits the adding of more resources to the application by adding resources from within a single platform and without increasing the number of operating systems used in supporting the application. 2) for the consolidation of multiple applications, the scale-up solutions will provide the ability to add resources to more than one application from within the platform without increasing the number of operating systems used in supporting the application.

Scale-Out Solutions - from an application standpoint (e.g., email), the scale-out solution increases resources to the application by adding servers to the cluster of real or virtual servers. The addition of servers increases the number of operating systems supporting the solution.

Server –a computer, which provides some service for other computers connected to it via a network.

Storage – computer storage is the holding of data in an electromagnetic form for access by a computer processor. Primary storage is data in random access memory (RAM) and other "built-in" devices. Secondary storage is data on hard disks, tapes, and other external devices.